ANALYSIS

56(293), May, 2020

ISSN 2278–5469 EISSN 2278–5450

DISCOVERY

Adequacy of port reception facilities in APAPA port, Lagos Nigeria

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Article History
Received: 11 March 2020
Reviewed: 12/March/2020 *to* 15/April/2020
Accepted: 16 April 2020
Prepared: 21 April 2020
Published: May 2020

Citation
GBADAMOSI Kolawole T, OJO Ayoade A, ADENIRAN Adetayo O. Adequacy of port reception facilities in APAPA port, Lagos Nigeria. *Discovery*, 2020, 56(293), 291-303

ABSTRACT

This study explored the major criteria for determining the adequacy of port reception facilities to ensure compliance of shippers in safeguarding the environment. Marine pollution remains a major problem in the Nigerian environment. Shipping and seaport activities as a factor of urbanization and industrialization have contributed to the scale of pollution. The primary data was collected through simple random sampling technique which is a probability sampling that is capable of giving sample representation and generalization from the population. The examination of port adequacy concerning port reception facilities revealed that the port reception facilities were performing and at good operational services, meanwhile the paired t-test on the MARPOL waste category revealed that oily bilge water (0.044), sludge (0.004), slops (0.000), scale and sludge from tank cleaning (0.000), sewage (0.012), plastic (0.05), operational waste (0.000) and cargo waste (0.000) were efficiently handled with a significance level less than 0.05 (critical region). This study recommends a thorough inspection, monitoring, control and enforcement of Marpol 73/78 within the jurisdiction of the flag state for checking violation, criminalities, and also preserves the marine environment. The need for acquiring

modern equipment to test and detect pollution is essential to enhance the sufficiency of evidence for the prosecution and discourage further pollution occurrences.

Keywords: Criteria; Adequacy; Port; Reception; Facilities

1. INTRODUCTION

The maritime industry is characterized by prescriptive standards and reactive approaches concerning safety and risk management, the emergence of safety in shipping has been promoted, especially by the International Maritime Organization within various interest groups such as owners/operators, charterers, insurers, ports, cargo owners and passengers (Schröder-Hinrichs *et al*., 2013). Despite the complexity of defining safety and maritime safety, Rollenhagen (2005); Pierre, Michel, Lucie, Leif, Romer and Ragner, (2001) defined safety as "a condition in which hazardous substances are been controlled to enhance sustainable living".

Safety is a dynamic state resulting from the interaction of human beings with their physical, social, cultural, technological, political, economic and organizational environment. Hence, there is a need to establish a permanent state of vigilance and develop the mechanisms to control dangers continuously. Del Pozo *et al*., (2010) defined maritime safety as the combination of preventive measures intended to protect the maritime domain alongside with limiting the effect of accidental or natural danger, and damage caused to the environment. On a similar note Wess (2013), described maritime safety the process of implementing international and nationally agreed rules to minimize the risks to people, property and the environment. Safety and risk have an overlay relationship which can be perceived as an inseparable thin layer that allows evaluation of levels of protection from hazards and degree of freedom from danger. The alarming rate of the environmental consequence of shipping necessitates the need for policy subjected to reduction and possibility of absolute eradication of the negative impact of shipping on the environment.

According to Abowei, Akaso, and Bariweni (2011), negative externalities have a lot of relevance over the environmental issue which is assumed by the whole society, these policies are subject to reviews, evaluation and amendment as the situation arises, thereby preventing and regulating the negative externalities of shipping on the environment, through increased safety towards achieving sustainable maritime transport. The nonchalant attitude of ship-owners towards the issue of the environment remains a challenge, ship-owners prefers to compromise safety in whatever means to satisfy their profitable goals. For instance, a ship-owner may ignore the use of reception facilities and proceed with illegal discharge of ballast, in the waterways. Carpenter (2005) posits that some developing countries lack the provision of adequate waste handling facilities, monitoring and control mechanism in their ports. It has been pointed out amidst other issues that adequacy of reception facilities and forceful control mechanisms are insufficient in majority of the countries' ports.

Marine pollution remains a major problem in the Nigerian environment. Shipping and seaport activities as a factor of urbanization and industrialization have contributed to the scale of pollution. In the first section and fourth subsection of the 1982 United Nations Convention Article on the Law of the Seas (UNCLOS), the definition of pollution in the marine environment is the introduction or deposit of substances by man, directly or indirectly into the marine environment which is likely to result in negative effects on living resources and hazardous to human health (Onwuegbuchunam *et al*., 2017). Direct pollution from vessel discharges and upland maritime support operations introduce toxins, nutrients, bacteria, pathogens, pharmaceuticals, and plastics into waterways, vessel support operations, and port operations also, directly and indirectly, pollute waterways through a variety of sources such as greywater, bilge water, black water (sewage), and ballast water, antifouling paints (and their leachates), hazardous materials, garbage and other wastes, Arial deposition to aquatic habitats of stack emissions (Daniel *et al*.,2016).

According to Ball (1999), reducing marine pollution will require cost-effective ways for ships to unload their waste efficiently. The issue of providing port reception facilities is the responsibility of the Port State (Nguyen, 2017). A ship keeps generating wastes while operating at sea. Oily wastes (sludge) and slop generate mainly from purifying bunker fuel, treatment of bilge water and from cargo residues of a cargo tank. Slops and sludge thus generated are stored in their respective tanks. However, the capacity of these tanks is limited and requires emptying from time to time to make room for further generated slops and sludge (Shafiqul, 2001).

Multiplicity of equipment adopted for discharging waste varies with the degree and the fastidious nature of waste being extracted. Regarding the volume of waste deposit, larger facilities seems to possess some element of mobile features like barges, road tankers, and other similar land-based vehicles which is capable of moving to the location where the ship is docked, and can often time transfer the waste to a large storage facility (Ball, 1999). Adequacy of port reception facilities should be ensured to meet the users' needs, particularly from the biggest merchant ship to the smallest recreational craft, without causing undue delay to the ships using them. IMO laid emphasis on the pertinence of making reception facilities adequate in the line of implementing the

MARPOL convention and encouraging the Member States to adopt it. The Member States are usually those that party the MARPOL as port States for the purpose of fulfilling their treaty and providing adequate reception facilities.

This study aims at examining the major criteria for determining the adequacy of port reception facilities to ensure compliance of shippers in safeguarding the environment. The study is conducted in Lagos Port Complex Apapa Quay been the busiest port in Nigeria.

2. LITERATURE REVIEW

Akpama (2017) worked on the topic 'an examination of the effectiveness of the implementation of the MARPOL 73/78 Convention in Nigeria'; the study adopted both qualitative and quantitative research method. Among the notable findings challenging the effective implantation of MARPOL are the grant of waivers and pardon to vessels and shipping companies, non- compliance of foreign vessels to IMO rules and standards, inadequate implementation of MARPOL convention and lack of effective enforcement strategies for the implementation of existing laws.

Onwuegbuchunam *et al.* (2016) conducted a study on the analysis of ship-source marine pollution in Nigeria seaports, using a scientifically-based approach to determine the status of marine pollution in the port environment, and collecting samples from randomly selected ships at berths in seaport locations. After carrying out physicochemical and microbiological analysis of samples of ships' wastewater, their study revealed that Nigerian seaport environment is polluted. The study recommends a model for an integrated approach that combines laboratory evidence and existing regulations to produce a framework that could be employed by port pollution control administrators in the port environment.

Roger (2001) carry out a study on hazardous goods and their environmental impact, it is pertinent to note that the problem generated by transportation is relative to the handling and storage of hazardous goods in the harbour and its surroundings which pose a direct or indirect danger on to the environment. Their study revealed that dredging, transhipment and storage of goods as well as placing of infrastructure elements are sources of pollution and contamination to the marine environment.

John and Davies *et al.*, (1990) worked on "the environmental considerations for port and harbour development", the research explicitly elucidated the various factors of environmental hazards of marine environment either from direct or indirect sources. The environmental hazard is assessed through the risk analysis method; some of the common environmental problems pointed include the adverse effect of dredging, air pollution, ship discharges, oil spill detection and clean up. The research adopted the existing port regulations and conventions as the directional scope of enforcement and comprehension to determine the minimum acceptance of pollution. In conclusion, the study revealed the salient challenges of the environment thereby postulating policies and recommendations to prevent otherwise avert further pollution of the marine environment.

Kadafa *et al.*, (2012) worked on oil spillage and pollution in Nigeria with emphasis on the organizational management and institutional framework, some of the environmental issues identified includes; depletion of biodiversity, coastal and riverbank erosion, flooding, spillage of oil, flaring of gas, sewage and wastewater pollution, noise pollution, degradation of land and reduction in soil fertility, deforestation, and other environmental challenges. The study revealed that the existing laws to abate pollution are not well enforced to aid compliance among the recommendation professed includes, Strict implementation of government policies and reformation of judicial attitude towards litigation concerning the environment.

Roha, Thaib, and Wong (2016) worked on the topic 'towards sustainable ASEAN port development: challenges and opportunities for Vietnamese ports. The study focused on the efficient and effective implementation of various green activities seeking to reduce the environmental impact of shipping and related activities to attain a sustainable port development. Study findings revealed implementing improved environmental standards is a challenge for ports in the developing countries that is evidenced with epileptic standard of living and unbalanced economy.

Onwuegbuchunam, Ebe, Okoroji, and Essien (2017) worked on the framework for management and control of marine pollution in Nigeria seaports. The study examined sources of marine pollution and the effects of ship-based pollutants on the marine environment, the study also assessed the institutional arrangement for addressing marine pollution from ships visiting Nigeria ports. Findings show that multiple government agencies with duplicated functions weaken monitoring and control of pollution. An incorporated administrative model was proposed to combat the identified managerial issues.

According to Daamen and Vries, (2013); Wiegmans and Louw, (2011), there is need for port management to collaborate with urban management authorities for assessing projects that has to do with inhabitants around the port's areas which usually complain about the detrimental effects of port activities that is causing serious divergence between a port and its community. Meanwhile, internal social programs such as employee welfare, education and training play an important part in environmental management. Gupta et al. (2005) worked on an environmental management plan for port and harbour project. They noted that the environment is always vulnerable from oil and chemical spills from ships either from their operational activities or catastrophic accidents which

cause a health hazards, likewise, they noted the impacts on surface water quality are originated by sludge, sewage generated and bilge wastes, waste, discharges from oil and oil leakages, leakages of injurious materials from ships and in the shore. The study revealed the various sources of oil pollution, levels of pollution, control and disposal of waste. The study recommends the need for a strict environmental plan to serve as a guide for the safe marine environment and also ensure waste disposal following the IMO rules and regulations.

Nguyen (2017) carried out a study on the implementation of the port reception facilities regulations of the international convention for the prevention of pollution from ships (MARPOL) in Vietnam" the study indicates the level of adaptability of the port reception facilities in Vietnam, the main methodologies employed consist of both quantitative and qualitative data analyses, as well as the estimation method to analyze the IMO Manual on Port Reception Facilities. A SWOT analysis issued to evaluate internal strengths and weaknesses of the current situation of port reception facilities. The study finds out that the existing port reception facility will not be able to meet the increasing demand of discharge waste of ships and recommends the need for specific guidelines and plans to reduce waste from port operations, construction of new port reception facilities as well as upgrade existing port reception facilities to meet the increasing demand of discharge waste by ships.

Moses (2000) reviewed the "maritime safety and anti-pollution convention in Ghana" with contemporary interest on the National and International obligation of the country to potential risk and ensuring the safety of the marine environment. The ratified conventions, implementation and formulation of National legislation is assessed. It is deduced that Ghana rectified the relevant conventions related to the safety and anti-pollution, however, the pollution response and preparedness are not standardized likewise the implementation and enforcement are reported not to reflect realism in shipping and marine environment due to low finance and prioritization of maritime issues. It is also noted that the country lacks good facilities and legal framework to and complement the enforcement agencies functions and activities.

Adelana, Adeosun, Adesina and Ojuroye (2011) examined the "environmental pollution of oil in Nigeria" and professed solution and remedies to the identified environmental problem. They identified the deposit of oily water in the high sea. The discharge of oily water from cleaning of oily tankers, vandalization of oil pipelines bunkering and bunker fuel spillage as a result of engineering or human error. The study revealed that the major cause of pollution of the environment is as a result of an illegal dump of marine waste.

Sibusiso (2014) conducted a review on preventing measures of the South Africa's marine pollution, most especially those pertaining vessels causing oil pollution. Emphasis was laid on legal mandates regarding oil pollution prevention and responses. The study adopted gap analysis in comparison with Sweden standards. The study revealed that there is delay in domestication into law relevant oil pollution conventions and recommends the need to identify a mechanism that ensures smooth ratification, enactment and updating of International Conventions among the relevant authorities.

Umo and Nitonye (2015) worked on 'the effect and solution of marine pollution ranging from ships in the Nigerian waterways'. They identified bilge water, garbage and ballast water as a source of marine pollution which causes impairment of water quality and disruption of aquatic growth. The study recommended an intensified effort to the enforcement of environmental laws by the government thereby conserving and protecting the marine environment to ensure full compliance by operators in the industry.

Ware (2009) worked on "the assessment of the impacts of shipping on the marine environment", the study identified pollution by oil and hazardous or toxic substances from incidental, operational and illegal discharges, air pollution; discharge of operational wastes from ships (raw sewage and garbage litter), the release of toxic chemicals used in anti-fouling paints and leaching of heavy metals from anodes, ballast water discharge, pollution and physical impact through the loss of ships and cargo; physical and other impacts including noise and collision with marine mammals as the major ways shipping impacts the environment. The study revealed little progress has been achieved to develop and implement programmes and measure to reduce the illegal input of wastes from its marine sources. The study recommends individual system especially relating to cost recovery systems and incentives for ships to deliver waste in ports, raised awareness amongst ship operators, shipping agents, waste operators and environmental authorities of the environmental impact of illegal discharges into the sea and need for detailed and clear guidelines to ensure uniform implementation of safe marine policies.

Bengtsson *et al.* (2012) evaluated the environmental assessment of two alternative pathways to biofuels, the diesel route and the gas route, in the shipping industry. From their study, it is found that the gas route has better overall environmental performance than the diesel route indicating the use of biofuels as one possible measure to decrease the global warming impact from shipping.

Lai *et al.*, (2011) proposed a conceptual framework with several propositions to promote green shipping practices in shipping operations. Green practices in the shipping industry such as using clean-burning low sulfur fuels, environmental-friendly materials and equipment, and adopting environmental friendly design shipbuilding have a positive impact on green performances and firm competitiveness (Yang *et al.*, 2013). The study made suggestions on exercising control in the port and inspection of ship towards

realizing sustainable port development (Saenguspanvanich *et al.*, 2009). In the study of Walsh and Bows (2012), there was a strong and positive relationship between ship emissions and ship size in the shipping activities of United Kingdom. There was highlight on the need for determining ship emissions, and vessel size, particularly for smaller ships where the variance in emission factors are the greatest.

According to Sumaila (2013) study on building sustainable for transportation development in Nigeria, among the factors identified as a challenge to the development of sustainable transportation in Nigeria are poor and inadequate planning, safety and security challenges and environmental pollution. From the research, it is deduced that Nigeria lacks proper implementation, coordination of policies and rationale to poor administrative and political influence thereby rendering policies ineffective.

Ball (1999) conducted a study on port waste reception facilities in UK ports intending to ensure that adequate provisions are in place for reception facilities and detailed to reduce the amount of marine environmental pollutants from ships deliberating discharging waste into the seas. The study indicated different types of ship-generated waste and the importance of constructing a waste management plan for the port authorities to ensure that ports provide adequate reception facilities for arriving ships.

Panayotova, Garbatov and Guedes (2005) conducted a study on the impact of pollutants and their sources on the black sea environment with an emphasis on the pollutants generated from shipping operations. They identified the discharge of insufficiently treated sewage, oily water discharge, air pollution and the presence of heavy metals as the major cause of pollution. They further recommend a more stringent implementation of legislation for the control and prevention of pollution.

Pavai (2015) worked on the proactive approach of maritime safety policymaking for the Gulf of Finland, seeking the best practices to avert pollution in the area. The study accentuated the increase in marine traffic and poor navigation condition of the gulf as a threat to a safe environment. This is the rationale to the fact that accident does occur in the form of collision. They suggested improvement in safety approach, policy formulation and management, frequent adjustment of policies following the globally accepted rules and regulations of IMO.

Knudsen and Hassler (2011) conducted a study on the failure of the IMO to execute apposite safety legislation for ship to reducing the accident rate of ship. In the study, it was concluded that the major challenge was the non existence of strong nexus between the national maritime and IMO administrations, with new regulations that are negatively affecting the functioning of existing language difficulties which sometimes hamper the implementation. Consequently, a few of ship accidents happened as a result of violating regulations or faulty implementation or non-implementation of the complex marine regulations.

Concerning environmental protection awareness around the globe, most European countries have been implementing various green solutions for reducing environmental impacts of shipping activities. Nonetheless, in Nigeria, there are few studies on the abatement of shipping impact and protection of the marine environment. Furthermore, most of the studies in the existing literature implicitly emphasized on the impact of shipping on the environment and overlooked the impact of shipping and protection of the marine environment in coherence with the assessment of enforcement and compliance with the relevant conventions protecting shipping and marine environment which is the aspiration for this study.

3. METHODOLOGY

This study adopted a survey research approach using a mixed methodology comprising of both quantitative and qualitative data. Primary and secondary data were adopted to achieve descriptive statistics. Structured questionnaires were administered to NIMASA (Marine Environment Management), NPA (pollution control department) and African Circle Pollution Management and ship captains. The selected population under study involved the staff of Nigeria Maritime Administration and Safety Agency (NIMASA) Marine Environment Management, NPA (Port pollution control department), African Circle Pollution Management and ship captains.

Table 1 Sample frame and size determination

S/N	Population of department	Population / Staff Strength	Sample Size	Percentage (%)
1	NIMASA (Marine Environmental Management Department) Kirikiri	78	43	25
2	NPA (Pollution Control Department) Apapa	43	24	14
3	African Circle Limited (Snake Island)	84	46	26
4	Ship Captains (Estimated ships berthed in Apapa port within a month)	108	62	35
	TOTAL	313	175	100

Source: Author's Field Survey, 2019

This sample population is deemed suitable for the research because their function is closely related to the shipping operation and regulations to prevent the occurrence of continuous pollution of the marine environment. Sampling enables the researcher to gain information from several respondents who represent the total proportion of the universe, thereby reducing the cost incurred and shorten the time scale of the research. The selected population is derived from the number of staff in the department that is directly involved and relevant in the study, refer to Table 1 for details.

Also, the sample population of the ship captains was determined from the estimated number of ships berthed in Apapa port. From the pre-field survey, a total of 1,412 vessels berthed at Apapa port in 2017. Hence, to estimate the total number of vessels that berthed in a month, the total annual vessels berthed was divided by 52.14 weeks in the year 2017.

Per week: $\frac{1412}{52.14}$ = 27

Estimated ship berth in one (1) month = 27×4 = 108

The Taro Yamane technique was adopted for this research work as thus,

$$n = \frac{N}{\left(1 + N\left(e^2\right)\right)}$$

where;
n = Sample size
N = Population of the study
e = Level of significance Note (e) = 0.05
1 = Unit (a constant).

$$n = \frac{313}{\left(1 + 313\left(0.05^2\right)\right)}$$

$$n = \frac{313}{\left(1 + 313\left(0.0025\right)\right)}$$

$$n = 175$$

Therefore, a total of 175 questionnaires were distributed.

The sample size was derived by multiplying each department population by the n (175) divided by total population N (313). For instance

Sample size for NIMASA= $\frac{78 \times 173}{313} = 43$

The study adopted a simple random sampling technique which is a probability sampling that is capable of giving sample representation and generalization from the population. This research adopts Primary (self-administered questionnaires) and secondary data with details of data required to achieve the aim of the study. A questionnaire was designed to gather information about the socio-economic demographic characteristics of the respondents as well as their personal opinions concerning the major criteria for determining the adequacy of port reception facilities and analyzed using Excel Microsoft coding sheet and SPSS.

Provision of adequate port reception facility is a salient factor in ensuring safe marine environment. The reception facility is a requirement under the international convention for the prevention of pollution from ships (MARPOL 73/78) for all state to establish to safeguard their marine environment and accept ship wastes which can pose threat to the environment. The ability of ships to comply with the discharge requirements of the treaty depends largely on upon the availability of port reception facilities; the unavailability or lack of adequate reception facilities in many ports worldwide poses a serious threat of pollution to the marine environment. The adequate capacity of reception centre to receive waste, location and accessibility of port reception facility,

logistics/ mobility of waste collection, the handling efficiency from cradle to grave, a funding mechanism to improve the equipment and technological standards at reception centre as well as maintenance of existing facilities, consistency and availability of waste reception service, the attractiveness of cost for port reception facility usage to discourage illegal discharge and delay factor towards receiving waste.

Secondary data was obtained from Nigeria Port Authority (NPA) on Marpol Compliance Inspection record in the form, total vessels inspected, the total number of vessels that discharged waste, garbage discharge record, liquid waste discharge record (sludge and bilge) Marpol violations in form of an expired license, illegal collection, illegal discharge of ballast water, sewage, garbage, sludge. Other sources include textbooks, various relevant documents and records both published and unpublished, libraries and internets.

4. RESULT AND DISCUSSIONS

Data presentation and analysis

The field data is generated through the administration and retrieval of valid questionnaires which were further analysed for this report. A total of 160 valid questionnaires were retrieved from 175 administered. This implies 91% of respondents captured.

The level of adequacy of port reception facilities available at APAPA port was achieved in two ways: firstly is the use of weighted mean rank; the second is achieved with the use of paired t-test for comparing waste availability and waste handling efficiency.

Table 2 Descriptive statistics of port reception facilities

Port reception facilities	Mean	Std. Deviation	Rank
Logistics	8.694	1.0931	1
standardized method of waste delivery	8.694	1.1046	2
Location	8.606	1.3922	3
African circle (Emergency Preparedness)	8.494	1.5172	4
Preparation and arrangement to receive waste	8.406	1.290	5
Consistency and availability	8.169	1.563	6
Adequate equipment	8.119	1.4379	7
Adequate funding	8.046	1.2467	8
Sufficiency and capacity to receive waste	7.969	1.261	9
Adequate port facilities	7.856	1.6593	10
Supervision	7.831	1.5056	11
Adequate port reception	7.693	1.9032	12
Provision of audit	7.656	1.3414	13
Periodic review	7.644	1.3334	14
NPA	7.550	1.5492	15
NIMASA	7.513	1.5781	16
Assessors expertise	7.425	1.4343	17
Reporting system	7.191	1.5817	18
Arrangement of vessels	7.094	1.8827	19
Cost of port reception	7.025	1.9745	20
Staff training	6.994	1.824	21
Delay factor	5.45	1.906	22

Source: Author's Field Survey (April 2019)

The result from Table 2 indicated that the top four most satisfying criteria for adequacy of port facilities are logistics, standardized method of waste collection, Location, African circle, preparation/arrangement to receive waste while the least ranked are reporting system, arrangement for vessels to deliver advance notification form, cost of port reception usage, staff training and delay factor on collection/ evacuation of waste. The low ranking of the cost of port reception usage and delay factor on the evacuation of waste is satisfactory, this implies that cost of port reception facility is affordable and encouraging for usage and

there's no delay in the process of waste evacuation thus it is in the good advantage of a well-functioning port reception system. Also, Table 3 highlights some of the functional facilities sited at the port reception centre. These facilities are considered a mandatory provision to support and ensure a standard establishment and seamless operation of the port reception centre.

Table 3 Facilities sited at port reception centre (ACL)

S/N	FACILITY/ EQUIPMENT	USES	STATUS
1	Incinerators	Used for burning solid and liquid wastes produced during ships operations	Functioning
2	Liquid Storage Tanks	Used for storage of oil residue mixtures	Functioning
3	Isuzu Garbage Trucks	Used for collection of municipal wastes and Garbage wastes from vessels	Functioning
4	Waste Compactor truck	Used for collecting municipal solid waste and transport it to a solid waste treatment facility, such as a landfill or transfer station	Functioning
5	Waste collection Barge	Used for collecting large quantity of liquid waste where vehicular access is impossible and small waste collection vessel is not appropriate	Functioning
6	Tankers	For evacuation of liquid wastes from vessels e.g. oily mixtures and Noxious Liquid Substance wastes	Functioning
7	Waste Collection Carts	For temporary storage or keep of sorted waste categories	Functioning
8	Flat-bed Waste Collection trucks	For collection of garbage wastes	Functioning
9	G-Force Plant Oily Water Separators	For purifying or recycling liquid wastes	Functioning
10	Drum Crushing & Scrub	Drum crushers are used to crush empty drums (55-gal to 85-gal) to small flat disks	Functioning
11	Balers & Hoppers	For compressing PET bottles into bails	Functioning
12	Glass pulverizer	For crushing glass materials or containers into different sizes. It can be crushed to pebbles and fine sands	Functioning
13	6Man Sorting Stations	Location for segregation and sorting of wastes	Functioning
14	MARPOL Vessel Maizube I, MARPOL Vessel Maizube II	For collection of wastes from vessels	Functioning
15	Shuttle Boats	For transportation of staff and guest	Functioning
16	Liquid Storage Tanks		
17	Waste Sorting Machine	For sorting different category of waste	Functioning
18	TSS 6-Man Sorter	For sorting waste	Functioning
19	4X4 Service Vehicles,	Utility operational vehicles	Functioning
		For scanning waste weight before and after	Functioning

20	Weight Scanner	processing	
21	Bailer	Used for bailing otherwise known as tying of compressed PET bottles into bail units	Functioning
22	Bob Cat SI30	For carriage of heavy equipment and waste loads	Functioning

Source: Author's Field Survey (April 2019)

Logistics: from the study conducted, it is evident that the port reception facility has a well-planned and functional logistics system to co-ordinate an effective operation of reception facilities, most especially for a state that operates a fixed port reception facility system like Apapa port, Nigeria. The provision of logistics is the responsibility of the Nigerian Port Authority hence the study show that the port authority is up to their role in the provision of logistics in form of operational vans/vehicles, Isuzu Garbage Trucks, Mercedes Benz Waste Compactor truck, Renault tanker truck, Flat-bed Waste Collection trucks, shuttle boats, MARPOL Vessel Maizube I, MARPOL Vessel Maizube II, MARPOL Vessel MV Etypou, not excluding the newly acquired MARPOL Vessels MV Aderinsola and MV Hadiza.

A standardized method of waste delivery: The study revealed that segregation of waste is practised adequately and in two main categories; solid and liquid waste. The solid waste consists of wastes such as plastics, food waste, domestic waste (e.g. paper products, rags, glass, metal, bottles, crockery, etc.). The segregation of waste involves the use of plastic bins and cart with labels on each of them to identify the kind of a waste to dispose of therein. Available at the reception centre is the man sorting station and a waste sorting machine which aids another session of thorough sorting and identification to ensure proper and effective handling of waste. Also, liquid wastes are been handled with the utmost care to avoid its spill into nearby water. The reception facility is provided with three (3) feed tanks for the storage of oily water, sludge, bilge etc.

Location; According to the study conducted the location of the port reception facility is rated appropriate because of its nearness to users, unhindered port operation, serene surrounding community (Noise, odour and appearance) appropriate licensing and agreement of facilities and operation and availability of spill cleanup and prevention equipment.

African Circle Pollution Management Limited (ACPML) Emergency Preparedness; The operation of ACPML have been well-rated and ranked as shown in table 4.5. This is as a result of its high safety practices, cradle to grave waste handling system and its continuous striving effort to make Nigerian territorial water habitable and sustainable by ensuring a pollution-free marine environment.

Cost of port reception facility usage; it is encouraged that port administrators and port authority shouldn't set their port user charges high in order not to discourage their customers from the use of reception facilities. When the charges are set high this will indirectly initiate continuous illegal waste dumping at sea and further render the reception centre under-utilized. From information gathered the cost of port reception use in Apapa port Lagos is rated low and ranked low, this means that the user charges are within the reasonable rate to encourage the use of port reception facility.

Staff Training: the study deduced that the current staff training investment capacity at African Circle Limited tends to be low meanwhile this does not mean that there is no staff training. The study suggests that to enable staffs to achieve their different goals effectively strategic actions such as harmonious industrial relations, right application procedures, efficient communication skills and system, research and development, technological advancement and know-how, training and development are required at regional, national and international phase. This will help to boost the capabilities of an employee with the most recent knowledge in the field operations.

Delay Factor; From the study, delay factor rated or ranked low implies that vessels do not encounter a delay in discharge of their wastes in other words ones a vessel is booked for waste discharge, the reception officers normally meet up as scheduled for its waste evacuation without affecting the vessel sail out schedule.

The second part was achieved with paired sample t-test which compares the availability of waste and its handling efficiency. The rationale for the paired t-test is because the responses we are comparing are gotten from the same entity twice as shown in Table 4.

Comparison between the availability of some categories of waste and their handling efficiency is shown in Table 4. The result shows that only nine out of the nineteen wastes categorized under MARPOL are efficiently handled. The result from Table 4 shows that oily bilge water, sludge, slops, scale and sludge from tank cleaning, sewage, plastic, food waste, operational waste and cargo waste have their handling efficiency significantly higher than their availability which implies they are efficiently handled while all other waste categories aside the nine mentioned above are not efficiently handled due to non-availability of waste and type of vessels call at the port. Therefore it can be concluded at present that the port reception facility is adequate and handles efficiently wastes generated at the high sea and port.

Table 4 Paired t-test for waste handling efficiency

Pair	Waste category (availability versus handling efficiency)	Mean difference	*T*	Df	Sig. (2-tailed)	Decision
1	Oily bilge water	-1.6203	-2.026*	157	0.044	Significant
2	Sludge	-0.4194	-2.922**	154	0.004	Significant
3	Slops	-0.7025	-5.066***	157	0.000	Significant
4	Dirty ballast water	-0.6815	-4.94	156	0.079	
5	Scale and sludge from tank cleaning	-0.462	-3.746***	157	0.000	Significant
6	Category X substances	0.1613	-2.099	154	0.237	
7	Category Y substances	0.2	-2.311	154	0.822	
8	Category Z substances	0.0839	-0.789	154	0.431	
9	Others	-0.2342	-2.777	157	0.906	
10	Sewage	-0.3734	-2.548*	157	0.012	Significant
11	Plastic	-0.1875	-1.979*	159	0.05	Significant
12	Food waste	-1.331	-12.481***	159	0.000	Significant
13	municipal waste	-0.775	-9.428	159	0.76	
14	Cooking oil	2.025	-16.528	159	0.765	
15	Incinerator Ash	1.5812	-13.906	159	0.541	
16	Operational waste	-0.3813	-5.003***	159	0.000	
17	Cargo waste	-0.9625	-10.403***	159	0.000	Significant
18	Animal carcasses	0.65	-5.234	159	0.543	
19	Fishing nets	1.15	-7.905	159	0.276	

***, **, * p-value significant is at the 0.001, 0.01 and 0.05 level respectively.

Source: Field Survey (April 2019)

Discussion of findings

The findings revealed that the port reception facility is adequate to handle waste and its wastes are handled efficiently. This finding is in agreement with (Momoh, 2013) discovery the port reception facility capacity is adequate for the present and future ship waste demand, meanwhile, the findings in this study do not agree with Onwuegbuchunam *et al*., (2017); Umo and Nitonye (2015) whose study discovered that ship source pollution in the ports essentially emanate from black wastewater, bilge wastewater, operational discharges and agrees that ballast wastewater is a source of pollution to the marine environment. At present, the port reception withholds the capacity equipment and facility to handle these wastes in exception of dirty ballast water. This exception could be attributed to the fact that Nigeria is currently at the sensitization stage of the ballast water management convention (BWMC) and progress is expected towards translation and promulgation the convention into national legislation for implementation and proper enforcement.

5. CONCLUSION

The sample size for this study was one hundred and seventy-five (175), a total of 175 questionnaires were distributed and 160 was retrieved. This implies the study can capture Ninety-one per cent (91%) of its respondents. Weighted mean rank was used to assess the respondent opinion on various standards to curtail pollution of the marine environment, oil filtering equipment, influence of technological development, Oil Discharge monitoring and control system, Notification of IMO on port reception inadequacies, and provision of port reception facilities as the top five environmental safety standards or approach to curtail pollution of the marine environment, while The least ranked are an investigation of infringement, encouragement of research and development, adequate prosecution of offenders and sufficiency of evidence for prosecution which implies enforcement of MARPOL 73/78 convention is relaxed or weak.

To examine the level of adequacy of port reception facilities available at Apapa port, the opinion of respondents were sought for each of the port reception attributes and ranked in descending order of mean response. The study revealed the top four most

satisfying attributes for adequate provision of port reception facilities are Logistics, Satisfied service rendered by African circle pollution management, standardized method of waste collection and logistics. Among the least ranked is the cost of port reception usage and delay factor. These attributes were ranked low from the rating scale of the respondent which reflects a good status of port reception facilities provision.

The study further used a sample paired t-test to determine the handling efficiency of wastes. The study revealed nine of nineteen waste listed on Marpol convention are efficiently handled. The wastes efficiently handled are oily bilge water (0.044), sludge (0.004), slops (0.000), scale and sludge from tank cleaning (0.000), sewage (0.012), plastic (0.05), operational waste (0.000) and cargo waste (0.000) while wastes such as category X, Y, Z and others which are listed under Noxious liquid substance waste, municipal waste, dirty ballast water, cooking oil, incinerator ash, animal carcasses and fishing net records less handling efficiency due to lack these wastes availability and lack of equipment and facilities to accommodate their processing and types of vessels that call at the port.

This study recommends a thorough inspection, monitoring, control and enforcement of Marpol 73/78 within the jurisdiction of the flag state for checking violation, criminalities, and also preserves the marine environment. The need for acquiring modern equipment to test and detect pollution is essential to enhance the sufficiency of evidence for the prosecution and discourage further pollution occurrences.

AUTHOR CONTRIBUTIONS

K.T. Gbadamosi supervised the research from start to finish. A.A. Ojo performed the manuscript design and prepared the manuscript text. A.O. Adeniran performed the manuscript review and proofread.

ACKNOWLEDGEMENT

The writers appreciate the anonymous reviewers for their useful comments and laudable suggestions to improve the paper quality. Finally, the editorial committees are highly appreciated for their efforts during the assessment procedure.

CONFLICT OF INTEREST

The author declares that there is no conflict of interests regarding the publication of this manuscript. Also, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancy have been completely observed by the authors.

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